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Implications of Pb-Free Microelectronics Assembly in Aerospace Applications

A. A. Shapiro^{*†}, J. K. Bonner^{*}, D. Ogunseitan[†], J-D. Saphores[†], J. Schoenung[‡]

^{*} California Institute of Technology, Jet Propulsion Laboratory

[†] University of California, Irvine

[‡] University of California, Davis

The commercial microelectronics industry is rapidly moving to completely Pb-free assembly strategies within the next decade. This trend is being driven by existing legislation in Europe and in Japan. The microelectronics industry has become truly global, as indicated by major U.S. firms already having Pb-free implementation programs. Among these forward-looking firms are AT&T, IBM, Motorola, HP and Intel to name a few.

Following Moor's law, the advances in microelectronics are happening very rapidly. In many cases, the commercial industry technology is ahead of the aerospace industry in technology. This advancement of commercial industry, along with cost, drives the use of Commercial Off-The-Shelf (COTS) parts for military and space applications. The aerospace industry will be, at some point, forced to use Pb-free components and subsystems as part of their standard business practices.

In this paper we attempt to provide a snapshot of the commercial industry trends and how they may impact electronics in the aerospace environment. Impacts will be felt in the areas of: reliability, assembly methods, cost drivers, supply chain selection and alternate materials selection.

In addition to the impact, we will also look at different strategies for implementation. It is not clear whether companies should immediately embark on a program to convert all of their electronics to Pb-free, whether they should phase it in and over what time frame. It is also not clear whether companies should try to comply with ISO14000 and what requirements should flow down to subcontractors and component suppliers. Legislation is pending in a number of states that may affect the decisions and timing. The EPA, through some university programs, is examining the implementation of Pb-free as well.

Finally we will present data collected on a recent NASA project to focus on finding suitable alternatives to eutectic tin-lead solders and solder pastes. The first phase of this project dealt with determining the most feasible candidates to replace tin-lead and to determine suitable processing operations in assembling printed wiring boards.

The world is moving toward implementation of environmentally friendly manufacturing techniques, Pb-free assembly being the first component of this trend. The aerospace industry will be forced to deal with the issues either by availability or legislation. This study should give some insight into some of the tradeoffs that should be considered.